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Average summer temperatures and hot days at Oxford

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Introduction

If maximum daytime temperatures exceed 25°C (77°F) both crop and animal production may suffer, particularly if high temperatures are maintained over a number of consecutive days. Most temperate crops have an optimum temperature for growth in the range 20 to 25 deg C. Periods of very high temperatures are also frequently associated with low levels of available moisture in the soil and high evaporation demand leading to stomatal closure in the middle of the day. Consequently leaf temperatures may be considerably higher than air temperatures measured in a Stevenson screen.

In the United Kingdom the problem of high daytime temperatures is largely confined to inland areas of central, eastern and southern England and a suitable station for analysis is Oxford for which 46 years data are available on magnetic tape.

Number of hot days and mean summer temperatures

Days with maximum temperature greater than or equal to 25.0°C at Oxford were printed out for the months May to August for the period 1931-1976. Most of the days occurred between 1 June and 31 August, but there were a number in late May and early September two days in April and one in October. It was found (Fig 1) that there was (as might be expected) a high correlation between the number of days with maxima $\geqslant$ 25°C in June, July and August (D) and the average of the mean monthly temperatures ($\bar{T}$) for the same months. The data could be fitted by a regression equation of the form:

$$D = -178.1 + 11.75\,\bar{T} \qquad r = 0.929$$

$$\text{for } \bar{T} \geqslant 15.2$$

This implies that if the climate changes so that the long-period average value of $\bar{T}$ is changed by 1°C the corresponding change in the average expectancy of hot days is about 12 days.

The relationship is not valid, of course, if $\bar{T}$ is less than 15.2°C. The mean number of "hot" days in June, July and August for each decade is given in Table 1.

Spells of hot weather

Table 2 gives the frequency of spells of hot weather of varying lengths starting in different months of the year, and table 3 the spells of 3 days or more in each year.

Table 1

Mean number of days with maximum temperatures $\geq 25^{\circ}C$ at Oxford

1931-40	16.2
1941-50	17.9
1951-60	11.5
1961-70	8.0
1971-76	16.2

Table 2

Frequency table of spells of "hot" days starting in each month

Length of run (days)	Month April	May	June	July	August	Sept	October	Total
1	2	15	30	37	29	7	1	121
2	0	4	15	20	19	6	0	64
3	0	0	7	16	13	3	0	39
4	0	1	8	2	11	1	0	23
5	0	1	4	3	3	0	0	11
6	0	0	2	6	1	1	0	10
7	0	1	1	3	1	0	0	6
8	0	0	0	3	2	0	0	5
9	0	0	0	1	0	0	0	1
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	1	0	0	0	1
16	0	0	0	0	0	0	0	0
17	0	0	1	0	0	0	0	1
18	0	0	0	0	1	0	0	1
Total	2	22	68	92	80	18	1	

Table 3

Spells of "hot" weather of 3 days or more at Oxford

Year	Dates of spells
1931	None
32	9.7-11.7, 9.8-12.8, 17.8-20.8
33	3.6-8.6, 2.7-7.7, 18.7-20.7, 22.7-27.7, 2.8-9.8, 25.8-29.8, 3.9-6.9
34	16.6-18.6, 3.7-11.7, 20.7-22.7, 13.9-15.9
35	22.6-25.6, 29.6-1.7, 9.7-16.7, 23.7-25.7, 4.8-8.8, 19.8-22.8
36	19.6-21.6
37	2.8-4.8, 6.9-9.9, 23.9-25.9
38	31.7-6.8
39	4.6-7.6
40	6.6-9.6, 3.7-5.7, 3.9-5.9
41	17.6-22.6, 30.6-3.7, 5.7-12.7
42	3.6-6.6, 21.6-23.6, 27.8-29.8
43	25.7-1.8, 16.8-18.8
44	27.5-31.5, 7.8-12.8, 14.8-16.8
45	13.7-15.7, 2.8-4.8
46	1.7-3.7, 9.7-13.7
47	28.5-3.6, 13.7-15.7, 25.7-29.7, 31.7-2.8, 12.8-29.8
48	25.7-30.7
49	25.6-28.6, 30.6-4.7, 10.7-15.7, 21.7-27.7, 13.8-15.8, 19.8-22.8
50	4.6-7.6
51	None
52	16.5-19.5, 26.6-2.7, 20.7-22.7
53	None
54	None
55	11.7-17.7, 31.7-2.8, 15.8-17.8, 20.8-26.8
56	25.7-27.7
57	14.6-18.6, 27.6-1.7, 3.7-6.7
58	7.7-9.7
59	4.7-8.7, 21.7-26.7, 7.8-9.8, 19.8-22.8, 24.8-26.8, 7.9-12.9
60	17.6-19.6
61	23.6-25.6, 29.6-1.7, 31.8-2.9
62	None
63	None
64	16.7-18.7, 3.8-5.8, 25.8-27.8, 3.9-5.9
65	None
66	17.8-20.8
67	10.7-13.7
68	None
69	11.7-16.7, 21.7-23.7
70	7.6-11.6, 1.8-4.8

Year	Dates of spells
71	7.7-9.7
72	None
73	13.8-16.8
74	None
75	26.7-9.8, 11.8-14.8, 26.8-29.8
76	6.6-9.6, 22.6-8.7, 10.7-12.7, 10.8-17.8, 22.8-26.8

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
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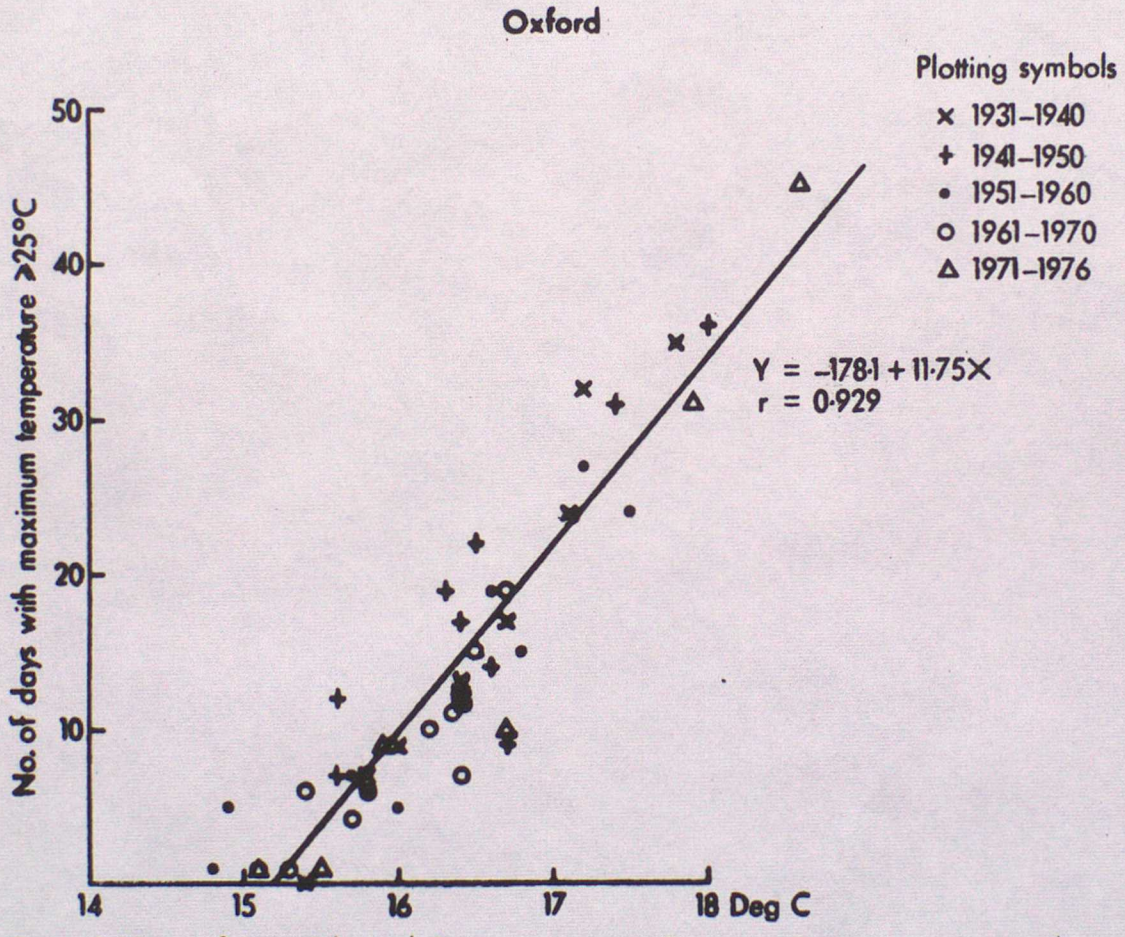

Figure 1 Mean of June, July and August average air temperatures